High-precision measurements of excited state lifetimes in rare earth nuclei with LaBr3 detectors

Dr Elizabeth Williams
A. W. Wright Nuclear Structure Laboratory, Yale University New Haven, Connecticut, USA
Current affiliation: *Department of Nuclear Physics, The Australian National University, ACT 0200, Australia.*

The strengths of electromagnetic transitions between excited states in atomic nuclei are key signatures of the evolution of nuclear structure. The way transition strengths vary as a function of nucleon number offers model-independent information about how collective excitations evolve as one adds protons or neutrons to a many-body quantum system, and can also provide a sensitive means of probing changes in nuclear shell structure for systems with exotic proton-to-neutron ratios.

Despite the essential role these transition strengths play in our understanding of nuclear structure, precision measurements of these quantities – generally obtained via excited state lifetime measurements – can be difficult to carry out. Fast timing scintillation detectors, composed of Cerium-doped LaBr3, have been shown to render previously challenging high precision lifetime measurements possible. Two excited state lifetime measurements on 168Hf and 174W were conducted at the Wright Nuclear Structure Laboratory using LaBr3 detectors and fast timing electronics. The performance of these detectors will be discussed, and preliminary results of these measurements will be presented in the context of work aimed at understanding the evolution of E2 excitation strengths in even-even collective nuclei.